

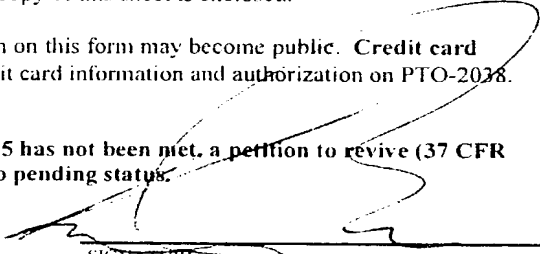
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Rec'd PCT/PTO 30 MAY 2001

FORM PTO-1190 (REV. 11-2000)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER 120671.90018	
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371				U.S. APPLICATION NO. (if known, see 37 CFR 1.5) 10/049178	
INTERNATIONAL APPLICATION NO. PCT/US98/25610		INTERNATIONAL FILING DATE 03 December 1998		PRIORITY DATE CLAIMED None Claimed	
TITLE OF INVENTION APPARATUS AND METHOD FOR THE MANUFACTURE OF REDUCED AND LOW FAT PASTA FILATA CHEESE					
APPLICANT(S) FOR DO/EO/US HILGEMANN, Anthony J., NELLES, Jakob					
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:					
<ol style="list-style-type: none">1. <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.3. <input type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.4. <input checked="" type="checkbox"/> The US has been elected by the expiration of 19 months from the priority date (Article 31).5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2))<ol style="list-style-type: none">a. <input type="checkbox"/> is attached hereto (required only if not communicated by the International Bureau).b. <input type="checkbox"/> has been communicated by the International Bureau.c. <input checked="" type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US).6. <input type="checkbox"/> An English language translation of the International Application as filed (35 U.S.C. 371(c)(2))<ol style="list-style-type: none">a. <input type="checkbox"/> is attached hereto.b. <input type="checkbox"/> has been previously submitted under 35 U.S.C. 154(d)(4).7. <input checked="" type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))<ol style="list-style-type: none">a. <input type="checkbox"/> are attached hereto (required only if not communicated by the International Bureau).b. <input type="checkbox"/> have been communicated by the International Bureau.c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired.d. <input checked="" type="checkbox"/> have not been made and will not be made.8. <input type="checkbox"/> An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).9. <input type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).10. <input type="checkbox"/> An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)). <p>Items 11 to 20 below concern document(s) or information included:</p> <ol style="list-style-type: none">11. <input checked="" type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98.12. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.13. <input type="checkbox"/> A FIRST preliminary amendment.14. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment.15. <input type="checkbox"/> A substitute specification.16. <input type="checkbox"/> A change of power of attorney and/or address letter.17. <input type="checkbox"/> A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.18. <input type="checkbox"/> A second copy of the published international application under 35 U.S.C. 154(d)(4).19. <input type="checkbox"/> A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).20. <input checked="" type="checkbox"/> Other items or information: Postcard Receipt					

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U.S. APPLICATION NO. (if known) 10/049178 INTERNATIONAL APPLICATION NO. CT/US98/25610		ATTORNEY'S DOCKET NUMBER 120671.90018	
21. <input type="checkbox"/> The following fees are submitted: BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)): Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO. \$1000.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$860.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$710.00 International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$690.00 International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) \$100.00 ENTER APPROPRIATE BASIC FEE AMOUNT =		CALCULATIONS PTO USE ONLY 	
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).		\$	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE
Total claims	12 - 20 =		x \$18.00
Independent claims	2 - 3 =		x \$80.00
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$270.00
TOTAL OF ABOVE CALCULATIONS =		\$	690.00
<input checked="" type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.		+	\$ 345.00
SUBTOTAL =		\$	345.00
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).		\$	
TOTAL NATIONAL FEE =		\$	345.00
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +		\$	
TOTAL FEES ENCLOSED =		\$	345.00
		Amount to be refunded:	\$
		charged:	\$
a. <input type="checkbox"/> A check in the amount of \$ _____ to cover the above fees is enclosed. b. <input checked="" type="checkbox"/> Please charge my Deposit Account No. <u>17-0055</u> in the amount of \$ <u>345.00</u> to cover the above fees. A duplicate copy of this sheet is enclosed. c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>17-0055</u> . A duplicate copy of this sheet is enclosed. d. <input type="checkbox"/> Fees are to be charged to a credit card. WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.			
NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.			
SEND ALL CORRESPONDENCE TO:			
		SIGNATURE  Keith M. Baxter NAME 31,233 REGISTRATION NUMBER	



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OT06 Rec'd PCT/PTO 21 OCT 2002 #5

I hereby certify that this correspondence is being deposited with the United States Postal Services on the date set forth below as First Class Mail in an envelope addressed to: Commissioner for Patents, Washington, D.C. 20231.

Date of Signature

and Deposit: 10/15/02

Terri S. Flynn

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Anthony J. Hilgemann, et al.
Serial No.: PCT/US98/25610
Filed: December 3, 1998
For: APPARATUS AND METHOD FOR THE
MANUFACTURE OF REDUCED AND LOW FAT
PASTA FILATA CHEESE
Group Art Unit: ---
Examiner: ---

Commissioner For Patents
Washington, D.C. 20231

TRANSMITTAL LETTER

Dear Sir:

In the matter of the above-identified case and in response to the September 10, 2002 Notification of Missing Requirements, Applicants enclose an executed declaration and a copy of the Notice.

Applicants have enclosed a Fee Transmittal sheet indicating that the small entity fee of \$65.00 should be paid from Deposit Account 17-0055. No other fees are believed necessary to enter this Declaration. However,

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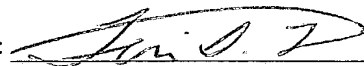
if other fees are necessary, please charge Deposit
Account 17-0055.

Respectfully submitted,

Anthony J. Hilgemann, et al.

October 15, 2002

By:


Terri S. Flynn
Reg. No. 41,756
Quarles & Brady LLP
411 East Wisconsin Avenue
Milwaukee, WI 53202-4497
(414) 277-5229

APPARATUS AND METHOD FOR THE MANUFACTURE OF REDUCED AND
LOW FAT PASTA FILATA CHEESE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of U.S. application 08/869,114 filed
5 June 4, 1997 entitled: Apparatus and Method for the Manufacture of Reduced and Low
Fat Pasta Filata Cheese hereby incorporated by reference.

STATEMENT REGARDING FEDERALLY
SPONSORED RESEARCH OR DEVELOPMENT

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10 BACKGROUND OF THE INVENTION

The invention relates generally to an apparatus and method for the production of
reduced and low-fat pasta filata cheeses such as mozzarella cheese, and in particular, to an
apparatus and process for incorporating a rice-based, reduced and low-fat cheese
substitute into pasta filata cheese without adversely affecting the texture of the cheese.

15 Pasta filata (plastic curd) cheeses are Italian-type cheeses in which the curd is
worked to develop a fiber or string-like texture providing an elasticity in the finished
cheese.

Pasta filata cheeses are kneaded while the curd is still in the plastic state to
develop the desired texture. This kneading was originally performed by hand, but now
20 may be performed by motor driven stretchers. In such a stretcher, augers fitting loosely
within a trough, stretch and compress cheese curd as it is conveyed along the extent of the
trough. The stretching develops the fiber or string-like quality for which pasta filata
cheeses are valued. The kneading process is conducted at approximately 140 degrees
Fahrenheit sufficient to provide plasticity to the cheese but below the temperature at
25 which the fiber structure of the cheese would be lost through melting.

Once the structure of the cheese has been developed, the cheese curd is transferred
to a molder/chiller system which divides the curd into blocks and cools it. Stretchers and
molder/chillers suitable for this purpose are also commercially available from the
Johnson/Nelles Corporation of Windsor, Wisconsin.

30 The cheese blocks may then be transferred to a brining pit in which cold brine
chills and floats the blocks to prevent deformation during the remaining cooling process.
The chilling in cold brine also adds some salt to the cheese. When the cheese block

center core has reached approximately 45 to 55 degrees Fahrenheit and has the desired salt content requested by the industry of 1.2-1.7%, it may be packaged.

Interest in reduced and low-fat foods has lead to the development of pasta filata cheeses incorporating low-fat cheese substitutes. Such substitutes are mixed into the milk used to generate the curd for the pasta filata cheese prior to its fermentation or may be blended into finished pasta filata by grinding the pasta filata and blending it with the substitute, then melting the blended ingredients together. While these products are frequently referred to as pasta filata type cheeses, their texture and quality make them readily distinguishable from true pasta filata cheese.

10

BRIEF SUMMARY OF THE INVENTION

The present invention provides a commercially practical method of incorporating a cheese substitute into a pasta filata cheese without detrimentally affecting its fiber structure. In the invention, the cheese substitute is made by combining rice grains and heated water and subjecting the mixture to high shear to liquefy it without substantial release of water. Although the inventors do not wish to be bound by a particular theory, this high shear method of producing a liquefied rice material is believed to preserve the structure of rice necessary to its great water holding capacity. Further this method is readily adaptable to large process volumes.

Specifically the method involves combining rice grains and heated water, subjecting the mixture to high shear to liquefy the mixture without substantial release of water, and combining the heated and liquefied mixture with finished pasta filata cheese. The combination is affected by kneading the combined mixture to alternately stretch and compress the combined mixture prior to cooling and molding of the pasta filata cheese.

It is a principal object of the invention to provide a method of producing a rice substitute high in moisture at large process volumes.

The high shear to which the mixture is subjected may be provided by a mixer head within a heated vessel and/or by a shear pump recirculating the mixture through the heated vessel.

It is thus another object of the invention to provide rapid and complete shearing of the rice and water mixture.

The tank may be a double walled vessel receiving the rice and water within an inner wall of the double walls and having an entry port and a lower drain orifice connecting into a center chamber and a steam source connected to the space between the

double walls to heat the inner wall. The mixer head of the shear mixer may be positioned within the vessel to contact the rice and water placed therein. A motorized scraper may scrape the inner wall that contacts the rice and water mixture.

Thus it is another object of the invention to provide an apparatus for preparing the
5 cheese substitute suitable for large production volumes. The double walled vessel construction allows heating of large batches of rice and ready shearing of the same.

The method may include the step of accumulating the liquefied mixture of rice and water in a second heated tank prior to its combining with the finished pasta filata.

Thus it is another object of the invention to provide for the integration of a batch-
10 type preparation of the rice and water mixture and a continuous manufacture of pasta filata cheese.

The foregoing and other objects and advantages of the invention will appear from the following description. In the description, reference is made to the accompanying drawings which form a part hereof and in which there is shown by way of illustration a
15 preferred embodiment of the invention. Such embodiment does not necessary represent the full scope of the invention, however, and reference must be made to the claims herein for interpreting the scope of the invention.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

Fig. 1 is a simplified perspective view of the apparatus of the present invention for
20 producing a reduced and low-fat pasta filata cheese showing a multiple auger heating system for the rice-based cheese substitute and a spray nozzle positioned over a hopper receiving standard pasta filata cheese and communicating with an upwardly extending kneading vessel;

Fig. 2 is a cross sectional view of the kneading vessel and spray nozzle of Fig. 1
25 taken along lines 2--2 of Fig. 1 showing the internal auger and the path of standard pasta filata cheese into the upwardly opening hopper;

Fig. 3 is a detailed fragmentary cross-sectional view taken along lines 3--3 of Fig. 1 showing two kneading augers within the kneading chamber of Fig. 2 in intermeshed counter-rotating configuration;

Fig. 4 is a block diagram of the apparatus of Figs. 1-3 showing the path of the rice
30 cheese substitute and standard pasta filata cheese during the process;

Fig. 5 is a cross-sectional view of a preparation vessel that provides an alternative method for the manufacture of the rice cheese substitute;

Fig. 6 shows an arrangement of a manufacturing line employing two kneading vessels of Fig. 2, two of the manufacturing vessels of Fig. 5 and two modified vessels similar to that of Fig. 5 providing holding tanks, together allowing for continuous manufacture of the pasta filata cheese of the present invention.

5

DETAILED DESCRIPTION OF THE INVENTION

Apparatus and Process

Referring now to Figs. 1 and 4, a reduced and low-fat cheese manufacturing apparatus 10 includes a motor-driven grinder 12 of conventional design having a hopper 14 sized to receive blocks of a rice-based cheese substitute 16 whose preparation will be described in detail below. An auger 18 (shown in Fig. 4) is positioned within the grinder 12 and driven by motor 20 to force the semi-solid rice-based cheese substitute 16 past a cutter head 21 so as to be macerated and extruded as indicated by arrow 22 for receipt by a second hopper 24.

The second hopper 24 opens into one end of a tubular heating chamber 26 which includes a second auger 28 driven by motor 30 to move the macerated rice-based cheese substitute 16 along the length of the tubular heating chamber 26 from the hopper 24 to an exit port 31 at the opposite end of the tubular heating chamber 26. The tubular heating chamber 26 is jacketed by a concentric hot water jacket 32 through which heated water 34 is passed. The heated water 34 is given a temperature so as to heat the macerated rice-based cheese substitute 16 to approximately 120 degrees Fahrenheit as it passes along tubular heating chamber 26.

When the rice-based cheese substitute 16 reaches exit port 31, it is sufficiently liquefied so that it may be received by a metering pump 36 of conventional design which provides a precise volume flow of the rice-based cheese substitute 16 into connecting pipe 38 leading to a second tubular heating chamber 40. Second tubular heating chamber 40 is similar in construction to tubular heating chamber 26 having a generally cylindrical lumen holding a third auger 42 driven by a motor 44 to move the liquefied cheese rice substitute from connecting pipe 38 to an exit port 46. Again, second tubular heating chamber 40 has a hot water jacket 48 regulated to adjust the rice-based cheese substitute 16 to a temperature from 185-190 degrees Fahrenheit. The heated and liquefied rice-based cheese substitute 16 exit port 46 to valve 50 which may recirculate the rice-based cheese substitute 16 through recirculation pipe 52 back to hopper 24 so as to constantly keep the

rice-based cheese substitute 16 flowing and heated, even if cheese is not actively being processed.

When pasta filata cheese is being processed, the rice-based cheese substitute 16 passes through tube 56 to a spray nozzle 58. The nozzle 58 is a length of pipe having a plurality of holes drilled in its lower surface to provide an orifice through which a rice-based cheese substitute 16 may exit.

Referring now to Figs. 1, 2, and 4, the reduced and low-fat cheese manufacturing apparatus 10 may be positioned to receive standard pasta filata cheese 60 directly from a stretching machine, but prior to its molding, chilling, or brining. Ideally, the pasta filata cheese 60 is delivered from the stretcher (not shown) at a temperature of approximately 140 degrees Fahrenheit and has a fully formed fiber structure. The pasta filata cheese 60 drops into hopper 62 at the base of an upwardly sloping kneading chamber 64. Referring in particular to Fig. 4, the kneading chamber 64 is jacketed with a concentric steam jacket 74 adjusted to a temperature of approximately 140 degrees Fahrenheit, but beneath the melting point of the cheese mixture 72. The spray nozzle 58 is positioned above the hopper so that liquefied and heated rice-based cheese substitute 16 may be sprayed upon the surface of the pasta filata cheese 60 as it enters the hopper 62. The flow rate of the pasta filata cheese 60 and the rice-based cheese substitute 16 from nozzle 58 may be adjusted so that the combined pasta filata cheese 60 and rice-based cheese substitute 16 (cheese mixture 72) is as high as 10-50% (preferably 35%) rice-based cheese substitute 16 by weight in the finished product.

Referring now to Figs. 2 and 3, positioned within the kneading chamber 64 are twin augers 66 having helical vanes 68 passing in helices of opposite "hand" around shafts 70 so that the vanes 68 may intermesh while the shafts 70 turn in opposite directions. A motor 76 turns the augers 66 through a conventional gear drive as will be understood to those of ordinary skill in the art. The augers 66 so turning provide a generally upward motion to the mixture of the pasta filata cheese 60 and the rice-based cheese substitute 16 through the kneading chamber 64.

The clearance between the vanes 68 and the walls of the kneading chamber 64 and the pitch and speed of the augers 66 is adjusted so that the cheese mixture 72 is stretched and folded between the augers and the inside of the kneading chamber 64 without cutting, so that the fibers of the cheese are preserved, yet coated uniformly with the rice-based cheese substitute 16. Generally, the augers 66 provide a similar action to hand kneading

in which the palm of the hand is pressed against a lump of dough of cheese to roll it along a hard surface, stretching and compressing the cheese back upon itself.

At the upper end of the kneading chamber 64 is an exit opening through which the cheese mixture 72 exits as a reduced and low-fat pasta filata cheese. It may then be received by a molder chiller or brining tank of conventional design.

The reduced and low-fat cheese manufacturing apparatus 10 is generally instrumented and controlled through a control panel 80 providing control for the speed of the metering pump 36 of the motors 30, 44, and 76 and of valves necessary to hold the temperatures of the hot water jackets 74, 48, and 32 within the range as described. The heated water 34 may be provided by a steam heat exchanger 82 shown in Fig. 4 which provides heated water 34 directly to hot water jacket 48 which may then be cooled and transmitted to jackets 74 and 32 by metering valve 84.

The Rice Cheese Substitute

The rice-based cheese substitute 16 is formed principally of rice and water mixed and heated until it reaches a gel-like consistency. Preferably, the rice may be crushed in a grinder to a consistency of approximately two millimeter particle size. A ribbon blender may then be used to mix the rice with approximately twenty five percent water by weight while it is heated to 160 degrees Fahrenheit for at least thirty seconds. The rice is then allowed to cool for approximately one hour with blending while other ingredients are added until it has reached approximately 70 degrees Fahrenheit. It is then molded into forty-pound blocks and refrigerated. The blocks are fed into the hopper 14 of the reduced and low-fat cheese manufacturing apparatus 10 as they are needed.

Although the exact composition of the rice mixture may vary, in a preferred embodiment the rice mixture is compounded of the following ingredients:

Ingredient	Percent by weight
Water	59 %
Rice	37.2%
Corn syrup	5%
Milk powder	3%
B950 food starch	3%
Maltrin M040	4.8%

The above description has been that of a preferred embodiment of the present invention. It will occur to those that practice the art that many modifications may be made without departing from the spirit and scope of the invention. For example, the composition of the rice-based cheese substitute 16 with respect to its minor ingredients
5 may be varied, particularly with respect to emulsifiers and flavoring agents. In order to apprise the public of the various embodiments that may fall within the scope of the invention, the following claims are made.

On-Site Manufacture of the Rice-Based Cheese Substitute

Referring now to Fig. 5, in an alternative embodiment to use of the grinder 12,
10 tubular heating chamber 26 and tubular heating chamber 40 (shown in Fig. 4) to prepare a premanufactured semi-solid rice based cheese substitute 16, these components may be replaced and the need for premanufacturing avoided by using a batch operated heated vessel 90 on-site.

The heated vessel 90 is a double-walled container having a cylindrical inner wall
15 92 surrounded coaxially by a cylindrical outer wall 94. The walls 92 and 94 continue around a lower base of their respective cylinders to culminate in an axial drain port 96 providing a passage from a mixing volume 98 surrounded by the inner wall 92.

The inner wall 92 and outer wall 94 define between them a steam jacket volume
20 100 into which steam may be introduced and extracted through ports 102. In this manner, the inner wall 92 may be heated to a controlled temperature so as to heat the material contained within the mixing volume 98.

An upper cover 104 joins the inner wall 92 and outer wall 94 at their upper edges
and covers the mixing volume 98. Cover 104 is breached by access hatch 106 into which ingredients as will be described may be introduced. A smaller entrance port 108 through
25 cover 104 allows for the recirculation of material from inside the volume 98 out through the drain port 96 and back into the entrance port 108 as will also be described.

Mounted on top of the cover 104 is a shear mixer motor 110 driving a shaft 112
piercing the cover 104 and terminating within the volume 98 at a high shear mixer head
116. Such mixer heads 116 are well known in the art and are commercially available
30 from Admix of Manchester, New Hampshire, United States under the tradename Rotosolver. During operation, the high shear mixer head 116 will rotate as indicated by arrow 118.

The shaft 112 may be off center to the center axis of the cylindrical volume 98 to allow for the passage of a scraper shaft 120 through cover 104 along the center axis. The scraper shaft 120 is driven by scraper motor 122 also mounted on top of cover 104. The scraper shaft 120 terminates at its lower end at a bearing 124 axially aligned with the
5 drain port 96 but supported above the drain port 96 so as to not obstruct it. Scraper shaft 120 rotates about its extent as driven by the scraper motor 122 and as indicated by arrow 121.

Extending symmetrically and radially outward from the lower end of the scraper shaft 120, above the bearing 124, are scraper arms 126 which follow along and above the
10 portion of the inner wall 92 forming the lower base and along and inside the portion of the inner wall 92 forming cylindrical vertical walls. Scraper blades 128 are attached along the arms 126 between the arms and the inner wall 92 so as to scrape along the inner wall 92 preventing overheating of material immediately adjacent to the heated inner walls 92. Scraper blades 128 are staggered with respect to the opposing arm 126 so as to provide
15 essentially uniform coverage of the inner wall 92 adjacent to steam jacket volume 100.

During operation, rice grains and heated water may be introduced through access hatch 106. Preferably the rice grains are unground rice comprising whole grains and broken grains such as naturally occur during grain shipping and handling. Other ingredients according to the table provided above may also be added at this time. Steam
20 introduced into the steam jacket volume 100 maintains the mixture at between 185 and 190° F. while it is blended with the high shear mixer head 116 and prevented from caking to the inner wall 92 by scraper blades 128.

Referring now to Fig. 6 during blending, the mixture may be extracted from drain port 96 to be pumped by positive displacement pump 130 and then by shear pump 132
25 through valve 134 back into entrance port 108 providing additional shearing of the mixture and its constant recirculation.

Still referring to Fig. 6, two such vessels 90 and 90' may be arranged to operate in tandem so that one vessel may be cleaned or refitted while the other vessel is creating the rice water blend. By means of valve 134, (or valve 134' on tank 90'), the contents of the
30 vessels 90 and 90', respectively, may be pumped to a pasteurizing tank 136 (or 136') being identical to vessels 90 and 90' except for the absence of the shear mixer motor 110, shaft 112, and high shear mixer head 116. Tanks 136 and 136' include inlet ports 137, 137' connected each to an outlet of valves 134 or 134'.

The pasteurizing tanks 136, 136' may each have a positive feed pump 140 (or 140') receiving mixture from the tank 136 or 136' through drain ports 139 or 139', respectively, corresponding generally to drain port 96 as pumped by the pumps 140 or 140' to valves 142 or 142' for recirculation back into the tanks 136, 136'. Valves 142 and 142' provide the rice water mixture to two way valves 146 and 146' which may direct the mixture either of hopper 62 or 62' of two corresponding kneading chambers 64 or 64' or to a second inlet on the other valve 146, 146'.

Thus, vessels 90 and 90' may be operated on a batch or intermittent basis with their product shunted to respective pasteurizing tanks 136 or 136' for pasteurizing and holding. Tanks 136 and 136' may hold the cheese rice substitute until it is needed and then via valves 142 and 142' set to provide either of the kneading chambers 164 or 164' with mixture. As have been previously described, each kneading chamber 164 or 164' includes an auger 66 or 66' for kneading the rice water mixture into pasta filata cheese.

It will be understood, therefore, that the kneading chambers 64 and 64' may be operated on an essentially continuous basis with the rice cheese substitute being manufactured in batches in vessels in 90 and 90'. Further the operation of the equipment need not be halted for cleaning operations of the vessels 90, 90', 136 or 136' as dual flow paths exist to either of the kneading chambers 64 or 64'.

The above description has been that of a preferred embodiment of the present invention, it will occur to those that practice the art that many modifications may be made without departing from the spirit and scope of the invention. For example, the rice based cheese substitute of the present invention may find use in process and other cheese types beyond pasta filata. In order to apprise the public of the various embodiments that may fall within the scope of the invention, the following claims are made.

CLAIMS

WE CLAIM:

1. A method of manufacturing reduced and low-fat cheese comprising the steps of:
 - (a) combining rice grains and heated water in a mixture;
 - (b) subjecting the mixture to high shear and heat to liquefy the mixture without substantial release of water;
 - (c) combining the heated and liquefied mixture with finished cheese prior to cooling and molding of the cheese; and
 - (e) molding and cooling the combined mixture.
2. The method of claim 1 wherein at step (b) the heated water is at a temperature substantially equal to boiling water.
3. The method of claim 1 wherein at step (b) the mixture is heated to a temperature of 85 degrees Centigrade.
4. The method of claim 1 wherein the amount of rice and water by volume stand in a ratio substantially equal to 1:2.
5. The method of claim 1 wherein the high shear of step (b) is provided by a mixer head in a heated vessel.
6. The method of claim 1 wherein the high shear of step (b) is provided by a shear pump recirculating the mixture through a heated vessel.
7. The method of claim 1 including the step of accumulating the liquefied mixture in a heated tank after step between steps (b) and (c)
whereby step steps (a) and (b) may be performed as a batch process and steps (c) - (e) may be performed continuously.
8. The method of claim 1 step of heating the walls of the vessel during steps (a) and (b).
9. The method of claim 1 step of scraping the walls of the vessel during steps (a) and (b).

10. An apparatus for manufacture of reduced and low-fat cheese from standard cheese and a rice based cheese substitute, the apparatus comprising:

a double walled vessel for receiving rice and water within an inner wall of the double walls and having an entry port and lower drain orifice communicating with a volume defined by the inner wall;

a steam source connected between the double walls to heat the inner wall;

a shear mixer having a mixing head suspended within the volume to contact rice and water placed therein;

a mixer for receiving a cheese and a rice water mixture and mixing them together;
and

a pump connected to the drain orifice to pump material to the mixer.

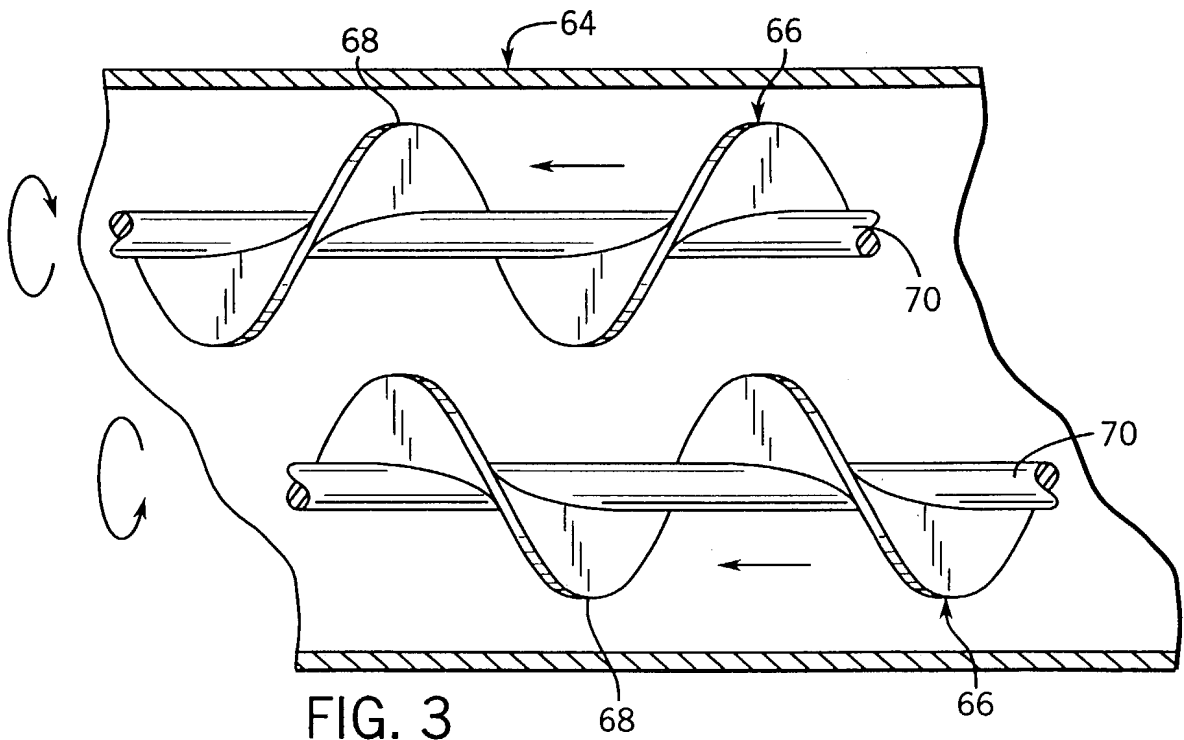
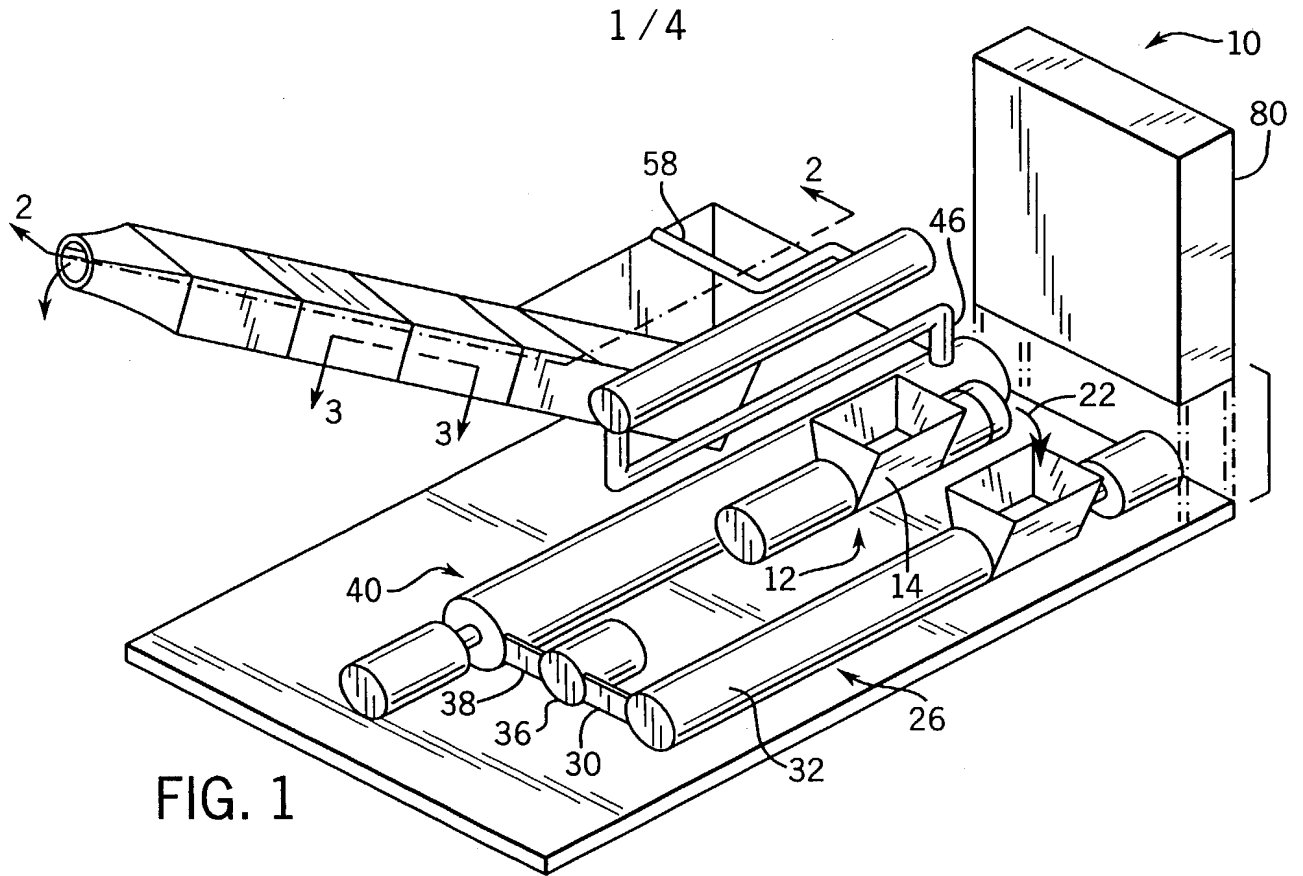
11. The apparatus of claim 10 including a valve having an inlet connected to the pump and having a first outlet connected to the entry port and a second outlet connected to the mixer;

whereby material may be circulated between the drain port and the entry port or transported from the drain pot to the mixer.

12. The apparatus of claim 10 wherein the pump is a shear pump.

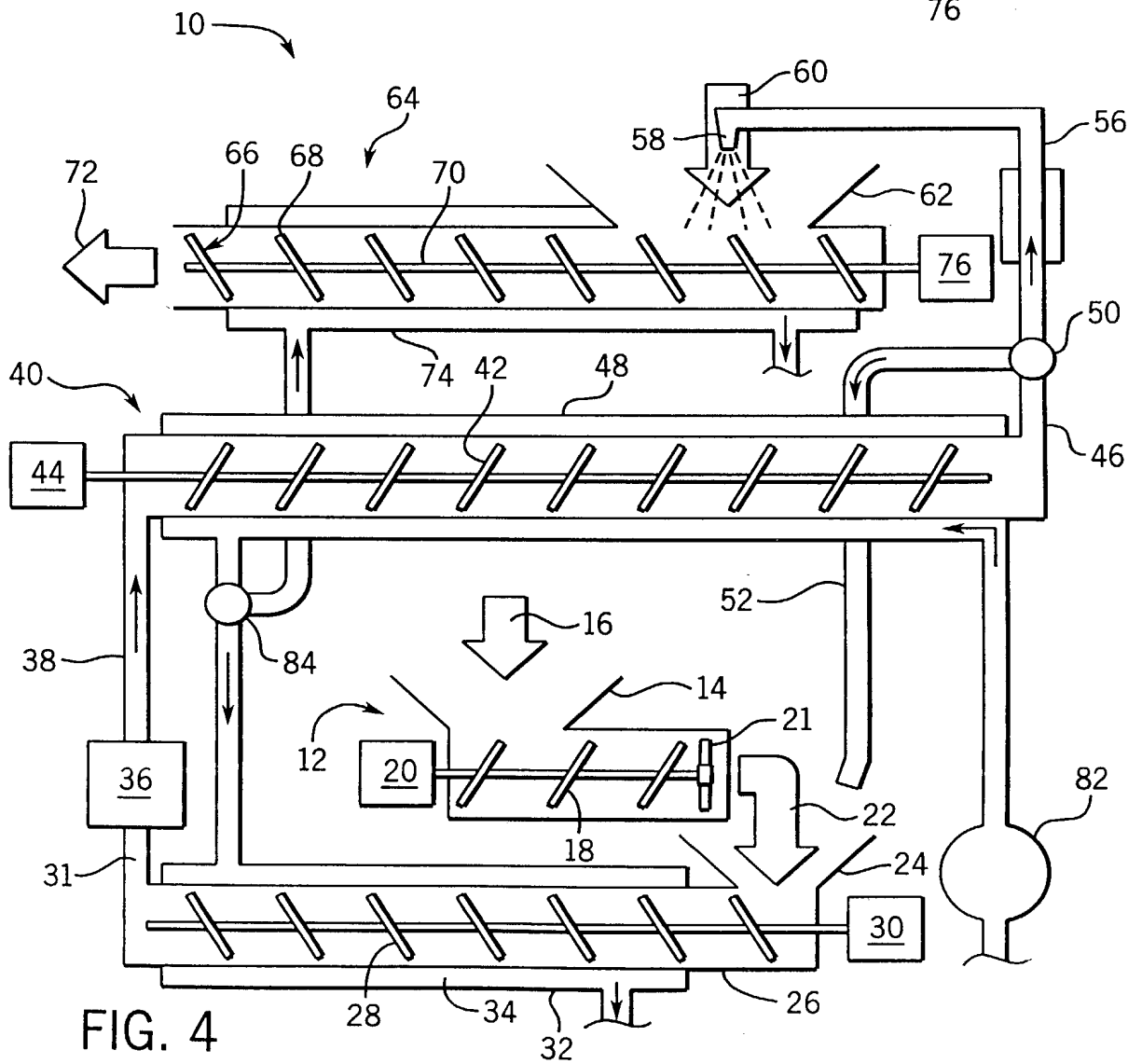
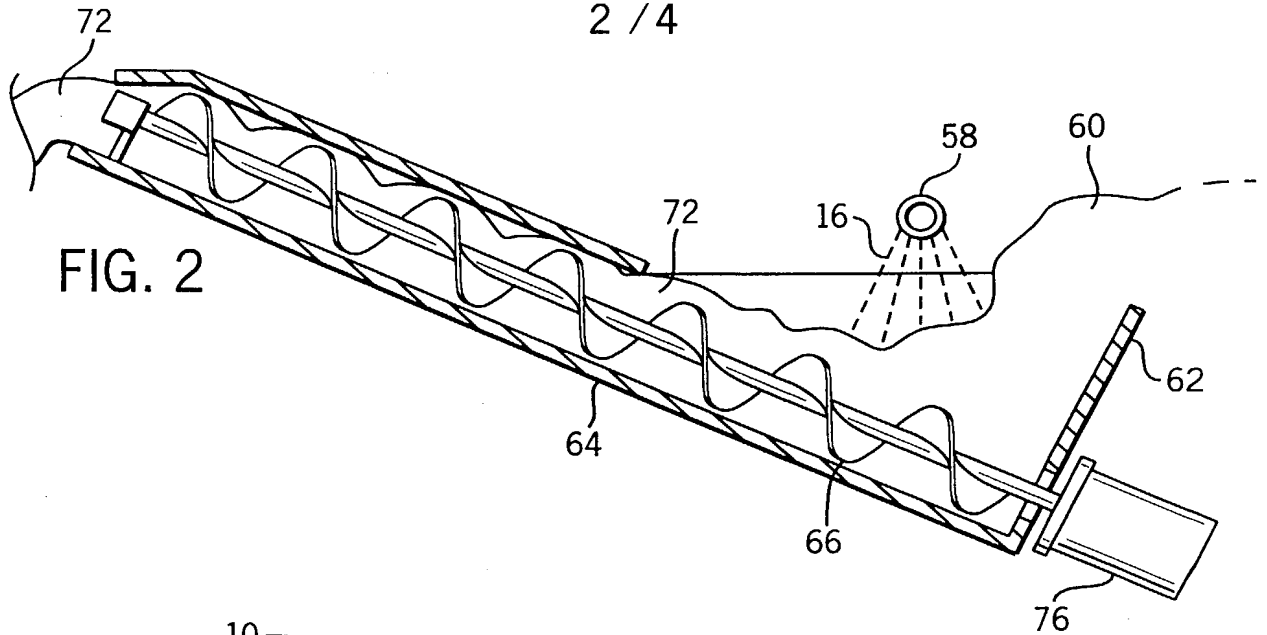
ABSTRACT OF THE DISCLOSURE

An apparatus and process for producing reduced and low-fat, high-quality pasta filata cheese incorporates a rice-based cheese substitute into freshly manufactured pasta filata cheese through a kneading, spraying process that preserves the integrity of the cheese's fiber structure. The rice based cheese substitute may be manufactured on-site with a heated double walled vessel equipped with a high shear mixer and recirculating shear pump.



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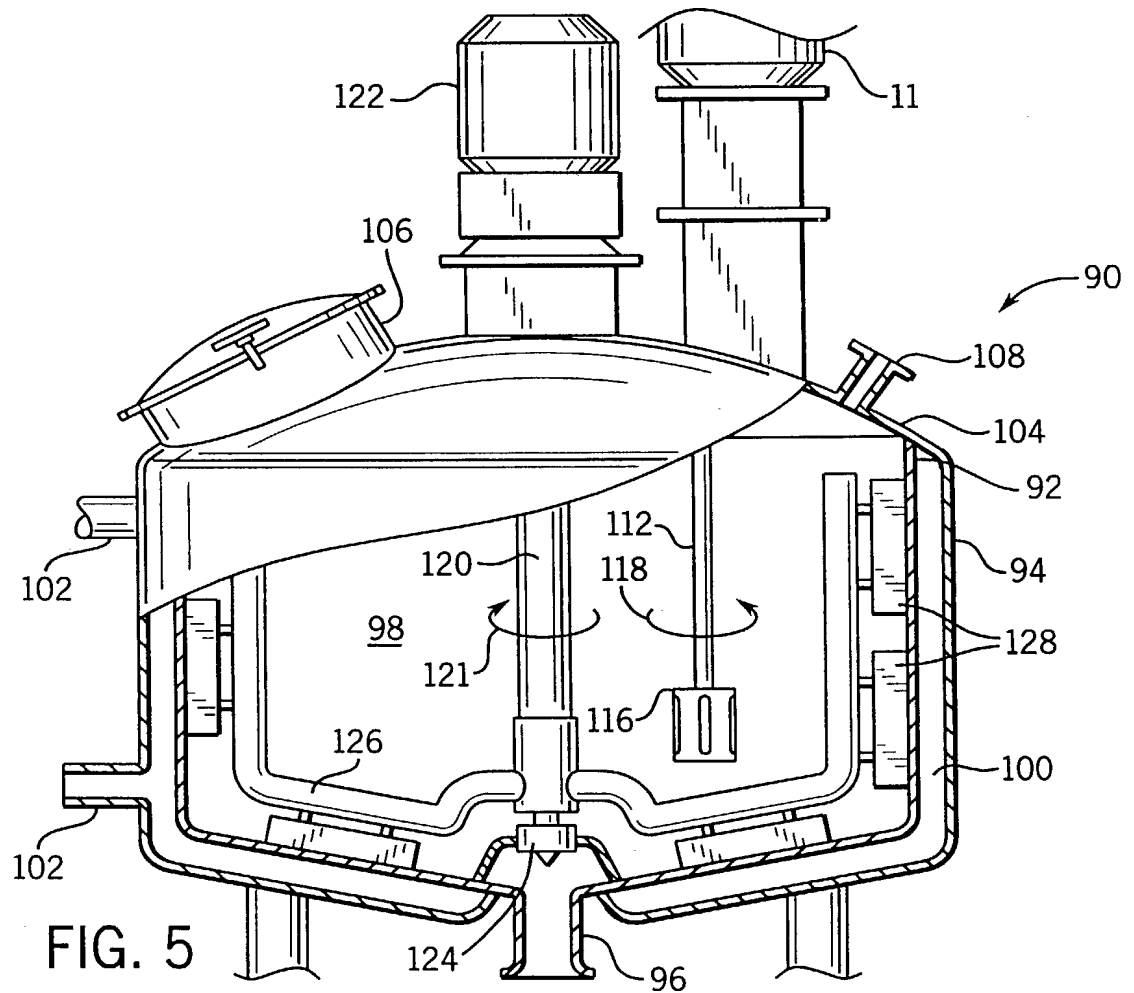


FIG. 5

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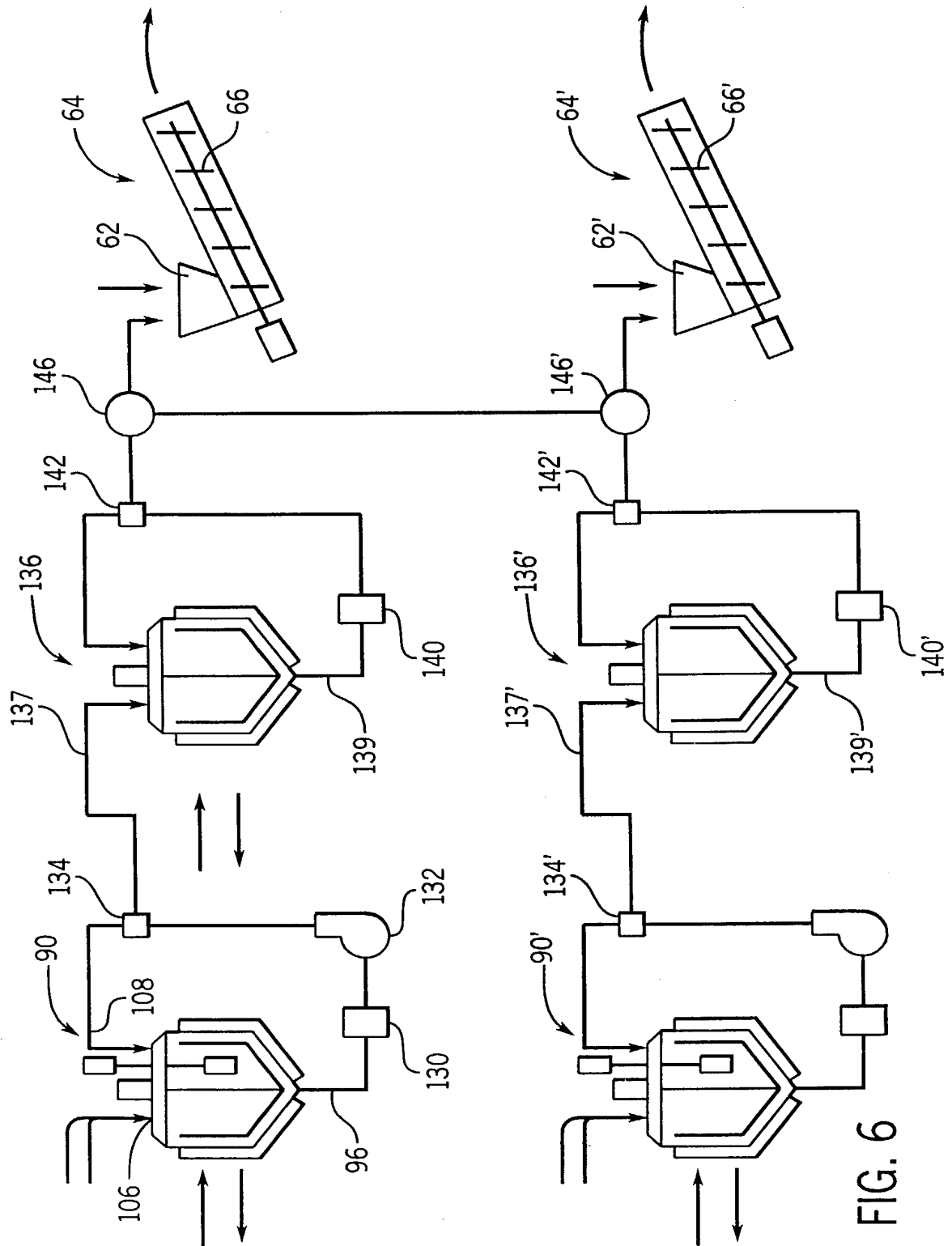


FIG. 6

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DECLARATION	Page 2
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I hereby claim benefit under Title 35, United States Code § 120 of any United States application(s), or § 365(C) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application or PCT international application in the manner provided in the first paragraph of Title 35, United States Code § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application Number	PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number (if applicable)
	PCT/US98/25610	12/03/1998	

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority sheet attached hereto

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and all continuation and divisional applications based thereon, and to transact all business in the Patent and Trademark Office connected therewith:



Firm Name
OR

Quarles & Brady LLP

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26710

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List attorney(s) and/or agent(s) name and registration number below

Name	Registration Number	Name	Registration Number

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Name of Sole or First Inventor:

A petition has been filed for this unsigned inventor

Given Name

Hilgemann

Middle Initial

J.

Family Name

Anthony

Suffix e.g. Jr.

Inventor's Signature

Anthony J. Hilgemann

Date

6-04-01

Residence:

Mosinee

State WI

Country

USA

Citizenship

USA

Post Office

1381 Plum Lane

City

Mosinee

State

WI

Zip

54455

Country

USA

Applicant Authority

☐ Additional inventors are being named on supplemental sheet(s) attached hereto

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DECLARATION										ADDITIONAL INVENTOR(S) Supplemental Sheet			
Name of Additional Joint Inventor, if any:										A petition has been filed for this unsigned inventor			
Given Name	Nelles			Middle Initial		Family Name	Jakob			Suffix e.g. Jr.			
Inventor's Signature	<i>Nelles</i>						<i>Jakob</i>			Date	6/6/01		
Residence:	Maquoketa					State	IA	Country	USA	Citizenship	USA		
Post Office	1048 Pershing Road												
Post Office													
City	Maquoketa			State	IA	Zip	52060			Country	USA	Applicant Authority	
Name of Additional Joint Inventor, if any:										A petition has been filed for this unsigned inventor			
Given Name				Middle Initial		Family Name				Suffix e.g. Jr.			
Inventor's Signature										Date			
Residence:						State		Country		Citizenship			
Post Office													
City				State		Zip				Country		Applicant Authority	
Name of Additional Joint Inventor, if any:										A petition has been filed for this unsigned inventor			
Given Name				Middle Initial		Family Name				Suffix e.g. Jr.			
Inventor's Signature										Date			
Residence:						State		Country		Citizenship			
Post Office													
City				State		Zip				Country		Applicant Authority	
Name of Additional Joint Inventor, if any:										A petition has been filed for this unsigned inventor			
Given Name				Middle Initial		Family Name				Suffix e.g. Jr.			
Inventor's Signature										Date			
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Additional inventors are being named on supplemental sheet(s) attached hereto													